Extensive Testing Conducted for the Advanced Subsonics Technology Regional Engine Combustor Program

A substantial amount of testing was conducted in combustion facilities at the NASA Glenn Research Center at Lewis Field for the Advanced Subsonics Technology (AST) Regional Engine Program. Hardware was tested for three engine-manufacturing companies: General Electric, Rolls Royce-Allison, and AlliedSignal Aerospace. The hardware, which varied from single fuel-injector modules to three-cup sectors, was tested in Glenn's Engine Research Building CE5 test stands (Stand 1 and Stand 2) and in Glenn's large Advanced Subsonic Combustion Rig (ASCR). A three-cup sector was run in two separate test series for AlliedSignal in Stand 1of CE5, and a three-cup sector for Rolls Royce-Allison in the ASCR, all at engine-operating conditions.

Measurement of pollutant emissions—NO_x, CO, and unburned hydrocarbons—was the primary objective of the tests, along with a determination of combustion efficiency. The results have been used in the design of a full-annular combustor to be run at AlliedSignal. For Rolls Royce-Allison, single modules were run in Stand 1 for both pollutant emissions as well as laser measurement of the fuel spray by Phase Doppler Particle Analysis (PDPA) and location of the flame front by OH imaging. Also for Rolls Royce-Allison, an important milestone was reached with the successful test run of a three-cup sector in the ASCR in September. The test demonstrated that NO_x emissions can be reduced by nearly 70 percent referred to the 1996 International Civil Aviation Organization (ICAO) Standards. For GE, single-fuel modules of a lean, direct injection (LDI) design by CFD Research Company (CFDRC) were run in Stand 2 of CE5, where emission and laser measurements were made. This capped a successful year that saw the timely completion of hardware testing for the three regional-engine AST contractors.

Glenn contact: Paul F. Penko, (216) 433–5356, Paul.F.Penko@grc.nasa.gov

Author: Paul F. Penko

Headquarters program office: OAST

Programs/Projects: Propulsion Systems R&T, AST